## **Report #094**

#### Red River Coal Company Benthic Macroinvertebrate Survey Fall 2012

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#### **EXECUTIVE SUMMARY**

Biological Monitoring, Inc. (BMI) performed a stream survey in the South Fork Pound River Watershed for Red River Coal Company. The purpose of this survey was to conduct instream assessments as outlined in Red River's permits. Six instream monitoring stations were sampled.

The Virginia Stream Condition Index (VASCI) protocol was used for instream biological surveys. All biological sampling was performed in accordance with the Virginia Department of Game and Inland Fisheries' scientific collection permit requirements.

Samples were collected on November 5<sup>th</sup>, 2012. Benthic samples were collected based on BMI's QAPP. All organisms were identified to the lowest practicable level and collapsed to the family level for VASCI calculation. The US EPA's Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers was used for sampling macroinvertebrate populations and performing habitat assessments.

The analysis of the Fall 2012 survey data yielded VASCI scores ranging from 20.61 (SFP-1) to 66.57 (SC-1). Using the Virginia Department of Environmental Quality devised scale, these stations were classified in the "Severe Stress", "Stress" and "Good" Aquatic Life Use (ALU) Tiers. The habitat assessment scores ranged from 151 (SC-1) to 167 (SFP-1A) falling into the "Suboptimal" and "Optimal" categories of habitat. Physicochemical and chemical analyses seem typical for mining influenced streams in the region.

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#### 1.0 INTRODUCTION

Biological Monitoring, Inc. (BMI) performed a stream survey for Red River Coal Company in the South Fork Pound River Watershed located in Wise County, Virginia. The purpose of this survey was to conduct instream assessments in fulfillment of permit requirements. The present report provides the methods utilized and the results obtained from the November 5, 2012 sampling event.

BMI is a Tier III (VA) bio-monitoring facility as well as a National Environmental Laboratory Accreditation Program (NELAP) accredited Whole Effluent Toxicity Laboratory. BMI specializes in issues of water quality. Since 1980, BMI has been providing expertise in aquatic toxicology and risk assessment. Highly motivated and academically trained scientists at BMI work closely with clients to create practical solutions to environmental problems. BMI has maintained a commitment to the research and development of aquatic biomonitoring and toxicological concepts resulting in leading edge technologies and applications.

BMI interacts with regulatory agencies on behalf of its clients to solve specific environmental problems associated with water quality and toxicological regulations and permit compliance. With its main facilities located in Blacksburg, Virginia, BMI focuses on the development and application of procedures to create feasible solutions that balance the need for environmental protection and continued economic development.

#### 2.0 METHODS AND MATERIALS

#### 2.1 General

On November 5, 2012, samples were collected from several instream stations in the South Fork Pound River Watershed. Generally, instream stations were sampled for benthic macroinvertebrates as well as analytical and physicochemistry.

Grab samples were used for analytical and physicochemistry. Macroinvertebrate samples were collected following BMI's Biological Monitoring Program Quality Assurance Project Plan for Wadeable Streams and Rivers (QAPP) (BMI 2012). The Virginia Stream Condition Index (VASCI) protocol was used for this instream biological survey (Tetra Tech 2003). The US EPA's Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers (RBP) was used for sampling macroinvertebrate populations and performing habitat assessments (USEPA 1999).

Qualitative habitat assessments were conducted at each bioassessment site by trained and experienced individuals. Physicochemical monitoring was performed in the field. Chemistry samples were collected and submitted to Environmental Monitoring, Inc. for analyses. This survey was conducted in accordance with Red River's permit conditions.

#### 2.2 Station Location

Six instream monitoring stations were specified for this project. Station location was provided by the permittee. These stations were located in Wise County, Virginia and in the South Fork Pound River Watershed. Latitude and longitude coordinates were recorded at the downstream extent of the station using a Garmin<sup>®</sup> Global Positioning System portable unit (GPSMAP 60 CSX). Table 1 summarizes the monitoring station

attributes. Figure 1 provides a map of the area and the location of the monitoring stations. Figure 2 presents an orthophoto of study area. Station photographs are presented as Appendix A.

 Table 1. Monitoring Station Attributes.

Station ID	Location Summary	Latitude	Longitude
SFP-1	Most upstream station	37° 03' 57.0"	82° 41' 40.6"
SFP-1A	Approximately 50m US Road Crossing	37° 04' 15.3"	82° 41' 02.8"
SFP-2	Downstream of confluence of Rat Creek and South Fork Pound River	37° 04' 45.9"	82° 39' 30.8"
SC-1	Mouth of Short Creek	37° 04 36.9"	82° 39' 29.4"
RC-1	Mouth of Rat Creek	37° 04' 36.3"	82° 39' 27.1"
GF-1	Mouth of Glady Fork	37° 05' 23.1"	82° 37' 51.4"

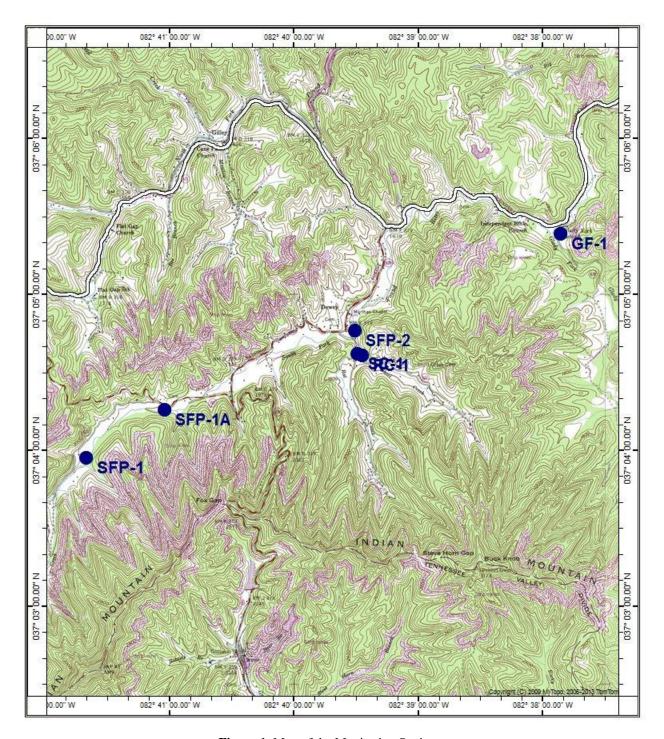


Figure 1. Map of the Monitoring Stations.

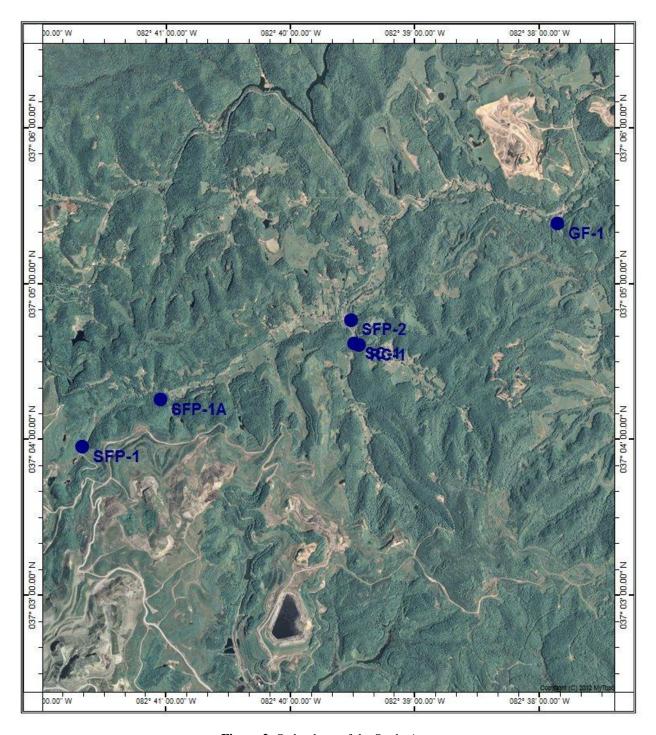


Figure 2. Orthophoto of the Study Area

#### 2.3 Macroinvertebrate Sampling & Assessment

#### 2.3.1 Sampling & Identification

All biological sampling was performed in accordance with the Virginia Department of Game and Inland Fisheries' scientific collection permit requirements. Macroinvertebrates were collected at each benthic station following the single habitat approach (riffle-run) as presented in the QAPP (BMI 2012). Samples were collected using a semi-quantitative approach.

Four samples were collected at each station using a 0.50 m wide rectangular kick-net having a 500 µm mesh size. Each sample was collected by first placing the net on the bottom downstream of the 0.50 m² area to be sampled. Where appropriate, large rocks and debris were brushed off into the net and removed. The area to be sampled was then vigorously kicked for approximately 30 to 90 seconds or the Best Professional Judgment of the scientist. For each monitoring station, the four samples were rinsed, composited, placed in a labeled container, and preserved in 70% ethanol. Sample information was recorded on a BMI Sample Chain of Custody Form and returned to BMI's laboratory for enumeration and identification.

Organisms were separated from the debris in the laboratory. Subsampling was performed on each sample to a standard count of  $110 \pm 10\%$ . All organisms were identified to the lowest practicable level. Organism identification utilized the appropriate taxonomic keys (Merritt and Cummins 2008). All data analysis was performed at the family level in order to use the Virginia Stream Condition Index (VASCI). All organisms from this study will be retained for a period of at least five years.

#### 2.3.2 Macroinvertebrate Data Assessment

Macroinvertebrate data were analyzed using *A Stream Condition Index for Virginia Non-Coastal Streams* (Tetra Tech 2003). This VASCI was developed from an analysis of data collected by the Virginia DEQ from 1994 to 1998 and 1999 to 2002. Using these data, VASCI designated statewide reference values were determined for each of the following eight metrics of community structure:

- Total Number of Taxa measures the total number of distinct taxa and, therefore, is representative of the diversity within a sample. High diversity is a strong indicator of stream health and ability to sustain populations. This metric value is expected to decrease in response to increased perturbation.
- Total Number of EPT Taxa is a measure of the total number of distinct taxa within the Orders Ephemeroptera, Plecoptera, and Trichoptera. These orders include the mayflies, stoneflies, and caddis flies, respectively. Organisms in these three orders have low tolerances to perturbation. As a result, the value of the metric is expected to decrease in response to increasing perturbation.
- **Percent Ephemeroptera** is the percentage of individual Ephemeroptera (mayflies) within a sample. This metric is calculated by dividing the number of Ephemeroptera by the total number of sample organisms. This metric indicates the relative abundance of this sensitive order within the stream community. The value of this metric is expected to decrease in response to increasing perturbation.
- **Percent P T Less Hydropsychidae** is the percentage of individuals from the orders Plecoptera and Trichoptera "less" the individuals from the family Hydropsychidae. This metric is calculated by dividing the number

of organisms from the orders Plecoptera and Trichoptera (less Hydropsychidae) by the total number of sample organisms. This metric indicates the relative abundance of these sensitive orders within the stream community. The value of this metric is expected to decrease in response to increasing perturbation.

- Percent Scrapers is percent abundance of individuals in the sample whose primary functional mechanism for obtaining food is to graze on substrate or periphyton, attached algae and associated material within a sample. This metric is calculated by dividing the number of organisms from the functional feeding group "scrapers" by the total number of sample organisms. The value of this metric is expected to decrease in response to increasing perturbation.
- Percent Chironomidae is the percent individual organisms of the Family Chironomidae within a sample. The metric is calculated by dividing the number of Chironomidae organisms by the total number of sample organisms. Family Chironomidae, the midges, are tolerant to perturbation and their relative abundance tends to increase in impacted streams. As a result, the value of this metric is expected to increase in response to increasing perturbation.
- Percent Two Dominant Taxa is the percentage of total individuals in the two taxa with the greatest number of organisms. The metric is calculated by adding the number of organisms present in the two largest taxa. Dividing this sum by the total number of organisms yields the relative abundance of the two dominant taxa. Samples with populations concentrated into a few taxa may be an indication of impact. This metric is expected to increase in response to increasing perturbation.
- Hilsenhoff Biotic Index (HBI) was originally designed to evaluate organic pollution by utilizing tolerance values to weight taxa abundance. The

resulting HBI value is an estimation of overall pollution level. The metric is expected to increase in response to increasing perturbation.

The VASCI metrics and their expected response to perturbation are summarized in Table 2.

Table 2. VASCI Metrics and Expected Responses.

Metric	Expected Response
Total Number of Taxa	Decrease
Total Number of EPT Taxa	Decrease
Percent Ephemeroptera	Decrease
Percent PT Less Hydropsychidae	Decrease
Percent Scrapers	Decrease
Percent Chironomidae	Increase
Percent Two Dominant Taxa	Increase
Hilsenhoff Biotic Index	Increase

VASCI scores for each of the monitoring stations were calculated by dividing each station's metric values by the corresponding VASCI statewide reference values. This yielded a percentage score for each metric relative to the statewide reference condition. If the percentage score of any individual metric was greater than 100, the score was truncated to 100. The eight resulting values were then averaged to arrive at the VASCI score for each station.

#### 2.4 Habitat Assessment

Habitat assessments were performed at each benthic station where macroinvertebrates were collected. These assessments were performed as per the RBP (USEPA 1999). Ten

habitat parameters were assessed, each receiving a score of 0 - 20. A description of each of the habitat parameters follows:

- Epifaunal Substrate / Available Cover rate the availability of structures in the stream that can be utilized as refuge, spawning, and feeding sites by macroinvertebrates. Examples of such structures would include boulders, cobble, undercut banks, roots, logs and branches. The availability of cover can be a limiting factor on stream diversity and abundance.
- Embeddedness rate the degree to which coarse substrate such as gravel; cobble and boulders are sunken into the sand, silt and mud substrate of the stream bottom. Embeddedness is the result of sediment movement and deposition. Increased embeddedness reduces the available refuge, feeding and spawning sites available to macroinvertebrates resulting in lower diversity and abundance.
- Velocity / Depth Regimes gauge the presence or absence of four velocitydepth patterns. These patterns are slow-deep, slow-shallow, fast-deep, and fast-shallow. Ideally, all four patterns should be present to best provide a stable diverse stream community.
- Sediment Deposition rates the degree to which new sediment has accumulated in pools, point bars and islands. Sediment deposition may be an indicator of an unstable environment and lowered diversity.
- Channel Flow Status rates the degree to which water fills the stream channel. Channel flow status may be affected by obstructions, diversions or widening of the stream channel. As less of the channel is filled by water, the amount of suitable substrate is also reduced.
- Channel Alteration rate the degree to which the shape of the stream channel has been altered. Alterations may include bridges, roads, diversion channels, channel straightening, artificial embankments, riprap,

dams, weirs, and other instream structures. Channel alteration often results in scouring and loss of available habitat.

- Frequency of Riffles (or Bends) rates the presence of quality riffle or sinuous habitat. Riffles and sinuous streams provide quality habitat for stable, diverse communities.
- Bank Stability indicates the degree to which banks have eroded or may erode. Eroded banks are a sign of sediment movement and deposition, which leads to reduced epifaunal habitat. Unstable banks may also point to poor vegetative cover.
- Bank Vegetative Protection gauges the extent of vegetative protection at the stream bank and the nearby riparian zone. Bank vegetation plays a vital role in erosion control, nutrient uptake, stream shading, and food supply.
- Riparian Vegetative Zone Width measures the extent of natural vegetation from the stream through the riparian zone. Wide vegetative zones provide pollution buffering, erosion control, habitat, nutrient uptake and nutrient input. These beneficial contributions can be impaired by commercial and residential development, roads, pastures, actively worked fields, etc.

Table 3 identifies each of the ten Habitat Assessment Parameters and their range of scores. Scores for each parameter were recorded on Habitat Assessment Field Log Sheets (USEPA 1999). The habitat assessment score for each station was calculated by adding the score for each parameter yielding a station total. The highest attainable score was 200. The actual habitat assessment process involves rating the ten parameters as optimal (>153), suboptimal (101-153), marginal (46-100), or poor (<45).

Table 3. Habitat Assessment Parameters

Parameter	Description	Scoring
1	Epifaunal Substrate / Available Cover	0-20
2	Embeddedness	0-20
3	Velocity / Depth Regime	0-20
4	Sediment Deposition	0-20
5	Channel Flow Status	0-20
6	Channel Alteration	0-20
7	Frequency of Riffles or Bends	0-20
8	Bank Stability	Left 0-10
o	Bank Stability	Right 0-10
9	Vegetative Protection	Left 0-10
9	vegetative i fotection	Right 0-10
10	Piparian Vagatatiya Zona Width	Left 0-10
10	Riparian Vegetative Zone Width	Right 0-10

### 2.5 Physicochemical Assessment

Prior to any field data collections, all handheld meters were calibrated. Conductivity ( $\mu$ S), Dissolved Oxygen (mg/L), pH (SU) and temperature (°C) were recorded at each of the sample stations, where appropriate. Conductivity, Dissolved Oxygen, pH and Temperature were all recorded using calibrated field meters. Field meters included an Oakton PCTestr 35 combination pH/EC/TDS/Temperature Meter and a Hanna model HI 9142 Dissolved Oxygen Meter.

## 2.6 Chemical Monitoring

Samples for analytical chemistry were collected and analyzed by Environmental Monitoring, Inc.

#### 3.0 RESULTS

#### 3.1 Station Location

Station attributes, including latitudes and longitudes are presented in Table 1 and depicted in Figures 1 and 2. Station photographs are presented in Appendix A. Flow was adequate for sampling at all stations.

#### 3.2 Macroinvertebrate Monitoring Data

#### 3.2.1 Virginia Stream Condition Index Metrics

The  $110 \pm 10\%$  subsample is summarized in Table 4. The VASCI metric values for the monitoring stations sampled are summarized in Table 5. Raw data are presented in Appendix B.

Table 4. Identification / Enumeration Data

Order	Family	SFP-1	SFP- 1A	SFP-2	SC-1	RC-1	GF-1
Colcontono	Elmidae				3		1
Coleoptera	Psepheniidae	1			1		
Diptera	Tipulidae	1		1	8	2	1
	Chironomidae	68	77	43	20	54	15
	Empididae					1	
	Simuliidae	32	1		6	1	3
	Baetidae				7	2	
Ephemeroptera	Ephemerellidae				2		
	Heptageniidae				3		
Plecoptera	Capniidae		9	23	8		31
	Leuctridae		11		26	3	
	Nemouridae				2	2	5
	Taeneopterigidae			9			33
Trichoptera	Hydropsychidae	3	19	27	9	33	12
	Philopotamidae				6	3	1
	Rhyacophilidae			1			6
Odonata	Calopterygidae	1					
	Gomphidae					1	
Megaloptera	Corydalidae	2					1
Oligochaeta		7			_		1
Collembola					7		
Isopoda	Asellidae				1		
	Total	115	117	104	109	102	111

Table 5. VASCI Metrics.

	SFP-1	SFP-1A	SFP-2	SC-1	RC-1	GF-1
Total Taxa	8	5	6	15	11	12
EPT Taxa	1	3	4	8	6	6
%Ephemeroptera	0	0	0	11.01	1.96	0
%Plec+Tric less Hydropsych.	0	17.09	31.73	38.53	27.45	68.47
%Scrapers	0.87	0	0	6.42	0	0.9
%Chironomidae	59.13	65.81	41.35	18.35	52.94	13.51
% Top 2 Dominant	86.96	82.05	63.46	42.2	72.55	57.66
HBI (Family)	6.05	5.05	4.46	3.47	4.53	2.85

#### 3.2.2 Virginia Stream Condition Index Scores

Table 6 presents a summary of the VASCI scoring. Raw data are presented in Appendix B. Each metric score represents a percentage of the statewide reference condition. The VASCI scores calculated ranged from 20.61 (SFP-1) to 66.57 (SC-1).

Table 6. VASCI Scoring.

	SFP-1	SFP-1A	SFP-2	SC-1	RC-1	GF-1
Total Taxa	36.36	22.73	27.27	68.18	50	54.55
EPT Taxa	9.09	27.27	36.36	72.73	54.55	54.55
%Ephemeroptera	0	0	0	17.96	3.20	0
%Plec+Tric less Hydropsych.	0	48.02	89.13	100	77.11	100
%Scrapers	1.69	0	0	12.45	0	1.75
%Chironomidae	40.87	34.19	58.65	81.65	47.06	86.49
% Top 2 Dominant	18.85	25.94	52.80	83.52	39.67	61.19
HBI (Family)	58.06	72.78	81.45	96.06	80.45	100
VASCI	20.61	28.86	43.21	66.57	44.00	57.31

Figure 3 is a graphical representation of the VASCI score(s) along with the Aquatic Life Use Tiers. It should be noted that four tiers exist in the VASCI, whereas, a score of 60 or higher is considered "unimpaired" and a score of < 60 is considered "impaired".

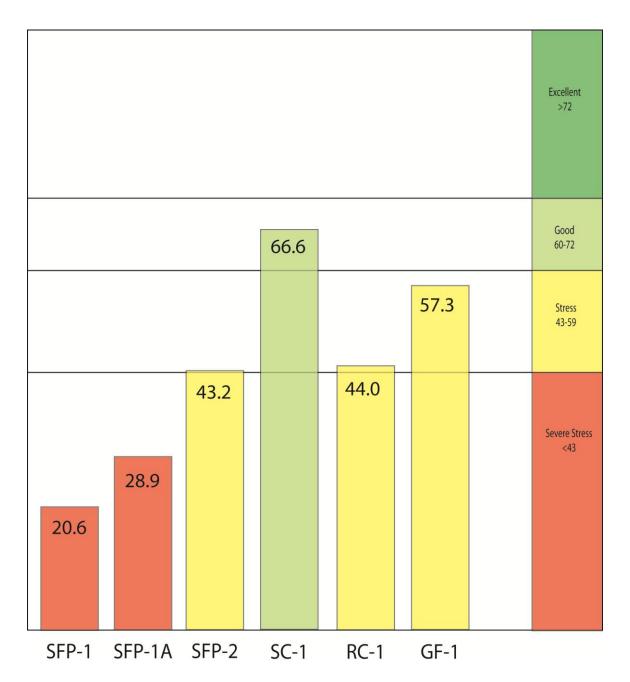


Figure 3. VASCI Scoring Summary

#### 3.3 Habitat Assessment

Table 7 presents a summary of the habitat assessment score for the monitoring stations. Raw data are presented in Appendix B. The habitat assessment scores ranged from 151 (SC-1) to 167 (SFP-1A) falling into the "Suboptimal" and "Optimal" categories of habitat.

Table 7. RBP Habitat Scoring.

Parameter	SFP-1	SFP-1A	SFP-2	SC-1	RC-1	GF-1
Subst./Cover	17	17	17	16	18	16
Embeddedness	15	13	15	13	14	15
Velocity	17	18	19	17	19	19
Sediment Dep.	13	15	16	14	14	15
<b>Channel Flow</b>	20	20	20	19	20	20
Channel Alt.	15	16	15	15	14	14
Freq of Riffles	18	19	20	20	20	19
Bank Stab L	6	5	8	9	9	10
Bank Stab R	9	8	9	9	7	8
Veg. Prot. L	6	10	8	6	10	10
Veg. Prot. R	10	10	5	8	8	5
Rip. Zone L	2	8	3	0	6	10
Rip. Zone R	10	8	0	5	2	2
Total	158	167	155	151	161	163

Figure 4 is a visual representation of the habitat score(s) obtained for this permit along with the different tiers.

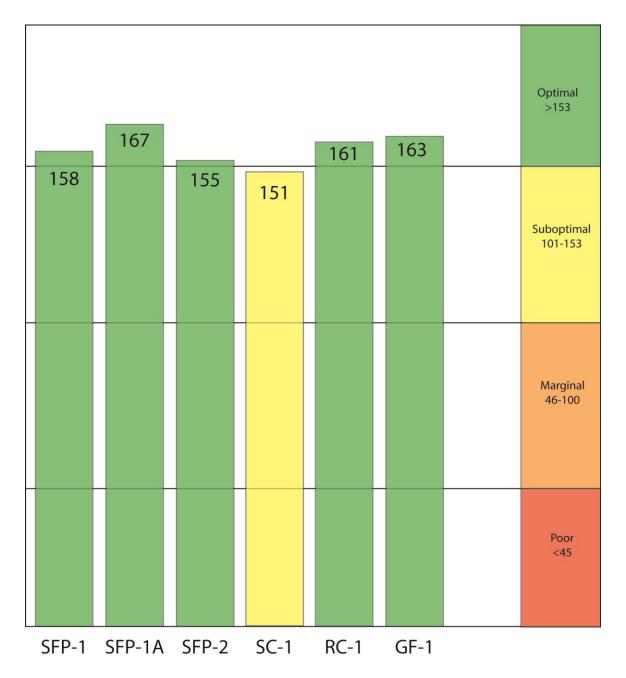


Figure 4. Habitat Scoring Sumary

## 3.4 Water Quality Assessment

Table 8 presents the water quality assessments.

Table 8. Water Quality Analyses.

	SFP-1	SFP-1A	SFP-2	SC-1	RC-1	GF-1
Conductivity (µS/cm)	2020	2060	1942	401	1224	512
Dissolved Oxygen (mg/L)	8.3	9.0	9.0	9.2	9.2	9.3
pH (SU)	7.6	8.2	8.4	8.1	8.0	7.9
Temperature (°C)	14.0	12.4	12.4	9.2	9.4	7.7

## 3.5 Chemical Monitoring

Results from the chemical monitoring are not included in this report. Results will be provided by Environmental Monitoring, Inc. separately.

#### 4.0 DISCUSSION

Water quality and both instream and riparian habitat are important determinants of the composition, structure, and function of biotic communities. The instream water quality assessments and the RBP Habitat Assessment techniques used in this study do not provide adequate discriminatory power to differentiate cause and effect. A systematic assessment of instream and riparian habitat quality is necessary to fully assess water quality conditions in streams and rivers (USEPA 1999).

#### 4.1 Station Location

Since the sampling locations were presumably specified in the permit, it is assumed that they are representative of the permit in question. Furthermore, this study represents a significant component of the holistic watershed management approach cited in DMLR Guidance Memorandum 32-10 Revised (DMLR 2011).

#### 4.2 Macroinvertebrate Data

The VASCI values in this study should be considered a relative ranking, indicating the comparability of the studied stream to the statewide reference for least disturbed streams. As such, these values should not be considered an absolute rating.

The VASCI validation document recommends Aquatic Life Use tiers based on the VASCI scores (VADEQ 2006). These tiers and their respective scores are as follows:

- > "Severe Stress indicates scores below 43;
- > "Stress" indicates scores from 43 to 59;
- ➤ "Good" conditions indicate scores from 60 to 72; and
- ➤ "Excellent" stream quality is represented by scores above 72.

The VASCI scores calculated for this permit ranged from 20.61 (SFP-1) to 66.57 (SC-1). These scores fall into the "Severe Stress", "Stress" and "Good" Aquatic Life Use tiers.

#### 4.3 Habitat Assessment

Habitat plays an important role in species composition, various assemblages and numbers of organisms found in aquatic environments. To make meaningful impact analyses, one must consider habitat data as a possible limiting factor. The habitat assessment scores ranged from 151 (SC-1) to 167 (SFP-1A) falling into the "Suboptimal" and "Optimal" categories of habitat.

RBP habitat assessment techniques are qualitative in nature and designed to determine comparability and ranking amongst stations. Traditionally, this approach assumes the presence of a reference station for the data set. To further explore the role habitat may be playing on the benthic score; additional data will have to be collected.

## 4.4 Water Quality Assessment

The water chemistry parameters examined, conductivity, pH, temperature and flow, were typical for streams influenced by urban environments and mining in the region.

#### 5.0 LITERATURE CITED

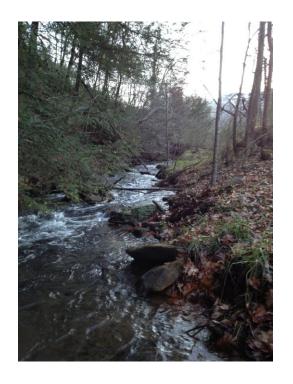
- Biological Monitoring, Inc. (2011) *Biological Monitoring, Inc. Quality Assurance Program Plan for Wadeable Streams and Rivers*; BMI; Blacksburg, VA.
- Buchanan, T.J., and Somers, W.P., 1969, Discharge measurements at gaging stations: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap A8, 65 p.
- Merritt, R.W. and K.W. Cummins (2008) An Introduction to the Aquatic Insects of North America; Kendall/Hunt Pub.; Dubuque, Iowa.
- Tetra Tech, Inc. (2003) A stream condition index for Virginia non-coastal streams. March 2003, revised September 2003; Owings Mills, MD.
- United States Environmental Protection Agency (1999) Rapid bioassessment protocols for use in wadeable streams and rivers, second edition; EPA 841-B-99-002. Washington D.C.
- Virginia Department of Environmental Quality (2011) Draft Guidance Memo No. 11-2007 2012

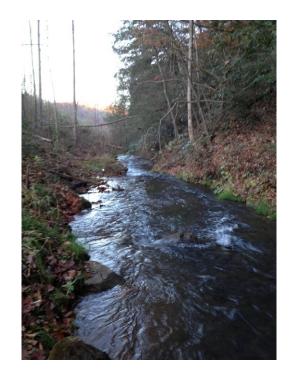
  Water Quality Assessment Guidance Manual; VDEQ; Richmond, VA.
- Virginia Department of Environmental Quality (2008) Biological Monitoring Program Quality

  Assurance Project Plan for Wadeable Streams and Rivers; VDEQ; Richmond, VA.
- Virginia Department of Environmental Quality (2006) Using Probabilistic Monitoring Data to Validate the Non-Coastal Virginia Stream Condition Index; VDEQ; Richmond, VA.

# APPENDIX A: STATION PHOTOGRAPHS

#### SFP-1



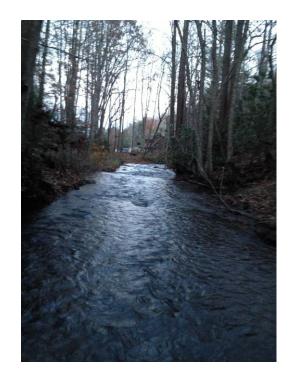






#### SFP-1A









#### SFP-2









#### SC-1









#### RC-1

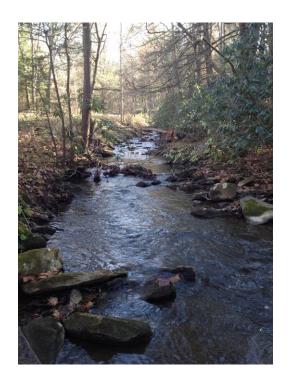


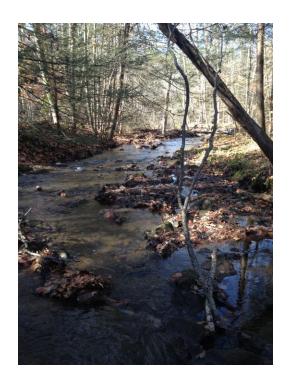




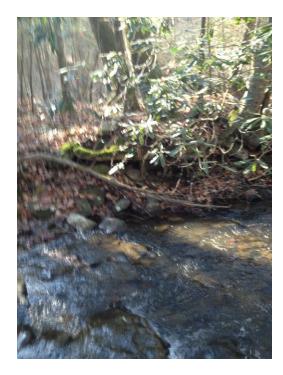


#### GF-1









## APPENDIX B: RAW DATA

u	
Station	SFP1

EPT Taxa	1.00	
Total Taxa	8.00	
Abundance	115.00	
Total PT	3.00	
Total Chironomidae	00'89	
Total Scrapers	1.00	
Total Ephemeroptera	00.0	
Total Hydropsychidae	3.00	

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	Two Dominant Taxa # %Top two dominant taxa   FFG #	HBI (Family)
0.00	0.00	0.87	59.13	100.00	96.98	696.00
SFP1						
	VASCI Metrics vs. Standard VASCI Metrics (Truncated)	VASCI Metrics (Truncated)				
Number of Taxa	36.36					
Number of EPT Taxa	60.6					
Percent E	0.00					
Percent PT Less Hydropsychidae	0.00	0.00				
Percent Scrapers	1.69					
Percent Chironomidae	40.87					
Percent Two Dominant	18.85					
Hilsenhoff Biotic Index	58.06					

Raw VASCI	Final VASCI
20.61	20.61

### **Benthic Macroinvertebrate Laboratory Bench Sheet**

Station ID:	SEPI	Sample Subsorted by:		Date Subsorted	:	
StationName:		# of Grids subsorted:				Ī
Date Sampled:		Total # of Subsorted Insects:			·	
Sampling Method:		Sample Identified by:	Time and the second	Date Identified:		No.
	<u> </u>					
ales		•	İ		Total # of	# to
4		TAXON	#	of larvae	Organisms	
1	Oligach	aeta	lacu		7	
2	Tipulida		1		1 1	
3 .	Simulad		HITHE MINE	user maser I I	32.	
4	Chiron		INT INT INT	W PHETHE BALL THE CHE	68	
5	Pseples	_	1	AT THE THE THE THE	1	
6	Corndo	lidae	lu .		7_	<del>- w</del>
7	Calepte	runder	1	<del></del>	1	
8	Hudiop	such das Coratorycle	10		3	,
9	1.03.11.26	3				
10					<del> </del> .	
11				<u></u>		
12						
13					<u> </u>	
14		·				
15		,,,, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	"	. •		
16	<del>*************************************</del>			**		
17						
18						
19				** <del>-</del>	·····	
20				**************************************		
21						
22				,		
23		-				
24				٠.		
25						
		TOTALS			115	

#### Sub-sample and Sample Reduction

(per SOP)

### Sub-sample and Sample Reduction Sheet

Organisms found in first grid = 57 (Grid # [8])

A minimum of 4 grids must be picked.

Magnifying visors are to be used when sub-sampling.

Grid I.D. #	# of Organisms	Grid I.D. #	# of Organisms	Grid I.D. #	# of Organisms		Grid I.D. #	# of Organisms
10	38	\						
8	10							
	-							

Total organisms = 7-26 Total grids = 4

IF after picking, there are >121 organisms, then return picked sample to 15-30 grid tray and remove grids (per SOP) to reduce sample to 121 organisms or less. Record data below.

Total # of organisms retained = \_ 115 Grids removed to reduce sample to 121 organisms or fewer = Percentage of grids retained for sample (to total grids) = (final corrected # of grids (# of grids from (% of grids

from original sample) original sample  $\{A\}$ ) retained)

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME 5	P1	LOCATION	سيو	in wal	in + mich	/W/
	VERMILE	STREAM CLAS	8		<del></del>	
LATLO	NG	RIVER BASIN			<del></del>	
STORET#		AGENCY	<u> </u>			
investigators 🦪	_77/-		<del>/, - · · · · · · · · · · · · · · · · · · </del>			'
FORM COMPLETED BY	n	DATE 11/5 I		REASON FOR S	SURVEY	
					Marin .	· · ·
WEATHER CONDITIONS	Now O storm	(heavy rain)			neavy rain in the las	at 7 days?
<u></u>	□ rain (: □ ahowens %□ %cl	steady rain) s (intermittent) loud cover ear/sunny	9	Air Temperature	<u>, , , , , , , , , , , , , , , , , , , </u>	
SITE LOCATION/MAP	Draw a map of the site	e and indicate the	areas sampl	ed (or attach a pho	otograph)	
		• .	in	mp		·
·	$x = x + f \cdot x$	<i>)</i>			•	
·				6 m		
1			•		v.	• • •
·		•	•			
	Pics	>		PF	1 7.6	
				1)(	83	٠.
	104	- 109		Cor	nd 20	020
				Te	mp 1	G, P
					· I · · ·	
•						
		· · · · ·	<u> </u>			
STREAM	Stream Subsystem		.1 -	Stream Type Q Coldwator	Warrows	
CHARACTERIZATION	Stream Origin  Glacial  Non-glacial montane  Swamp and bog	Spring-fed Mixture o		Catchment Area_	km²	

## PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATE	RSHED JRES	台級	tominant Surrounding I prest Cleom old/Pasture Finds gricultural Clothe	mercial strial	Obvious sources	ome potential sources
	<u> </u>		MOSUIEI	٠.	Local Watershed E. O None Official	rodon Ats Heavy
RIPAR VECE) (18 met	IAN FATION for buffer)		cate the dominant type sees	record the	deminant master was	Herbaccous
INSTRI FEATU	eam Dres	Estin	nated Reach Length nated Stream Width pling Reach Area	100m 5_m		antly shaded □ Shaded  25 m
		Area Estin	in km³ (m²x)000) nated Stream Depth	km² km	Proportion of Reach Morphology Types O Riffle (2) %	Represented by Stream
<u> </u>			cc Velocity siweg)	_ш/вес	Channelized 🗆 Yo Dam Present 🗀 Yo	
LARGE	WOODY	LWD Densi		_m²/km² (LWI	)/ reach area)	
AQUAT VEGET	IC ATION	domir	ate the dominant type are	nd record the Reoted submer Attached Algae	dominant species present gent O Rooted floating	O Free floating
WATER	QUALITY		erature °C	aric vegatation	2/2%	<u> </u>
		Dissol pH		- / '/ : :	O Petroleum O Fishy Water Surface Otls	wage Chemical Odder Clobs OFicks
			lity	, <u></u>	Tpatidity (if not mean	sured) urbid
SKDIME SUBSTR	NTI/ ATTE	Odora IZ Non O Cher II Othe	nal □ Sowago micai □ Anacrobic	O Petroleum O None	Deposits  Sludge C Sawdust  Relict shells	Of Paper fiber (I Sand
<u>.</u>	i	Of Abo	ut 🗆 Slight 🗆 Modera	ite 🗅 Profi	Looking at stones white are the and confides bla	ch are not deeply embedded, ck in color?
INC	ORGANIC SUBS (should ad	TRATE dup to	COMPONENTS 100%)		ORGANIC SUBSTRATE ( (does not necessarily add	COMPONENTS
Substrate Type	Diamete	٠	% Composition by Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
edrock .			£020	Detritus	sticks, wood, coarse plant	Samping Area
oulder	> 256 mm (10")		5	1	materials (CPOM)	15
obble	64-256 mm (2.5°	10")	<b>₩</b> 30	Muck-Mud	black, very fine organic	<del></del>
iravel	2-64 mm (0.1"-2	5")	30	1	(FPOM)	
and ,	0.06-2 <del>mm</del> (gritty)	1	10	Marl	grey, shell fragments	
ilt .	0.004-0.06 mm		- 5			
ley	< 0.004 mm (slick	c)				1
					<u> </u>	j. I

#### HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION # 5FP   RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 1/5/12 REASON FOR SURVEY

	Habitat		Condition	ı Category	
L	Parameter	Optimal	Suboptimal	Marginal	Poor
Su	Epifaunal bstrate/ railable Cover	Greater than 70% of substrate favorable for epifeumal colonization and fish cover; mix of snags, subtracted logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or responsed.	Less than 20% stable habitat, lack of habitat is obvious; substrate unstable or lacking.
sc	ORE		7. V.		
2. X	Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment
g sc	ORE				
	/elocity/Depth zime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fust-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or alow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
g SCC	ORE				
4. 5	ediment osition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, send or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
sco	ORE				
5. C Stat	hannel Flow	Water reaches base of both lower banks, and minimal amount of channel substrate is capaced.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
sco	DRE				

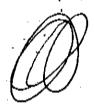
## HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Γ					···
1	Habitat Parameter	Optimal	Suboptimal	on Category	T
İ	6. Channel Alteration	Channelization or	Some channelization	Marginal Channelization may be	Poor Banks shored with gabion
	Atteration	dredging absent or minimal; stream with normal pattern.	present, usually in areas of bridge abutments; evidence of past	extensive; embankments or shoring structures	or coment, over 80% of the stream reach
			channelization, i.e., dredging, (greater than	present on both banks; and 40 to 80% of stream reach channelized and	channelized and disrupted. Instream
1			past 20 yr) may be present, but recent	disrupted,	habitet greatly altered or removed entirely.
			channelization is not		
	SCORE			And The And The	
	7. Frequency of	Occurrence of riffles relatively frequent, ratio	Occurrence of riffies infrequent; distance	Occasional riffle or bend; bottom contours provide	Occerally all flat water or shallow riffles; poor
	Riffles (or bends)	of distance between riffles divided by width of the	between riffles divided by the width of the stream is	some habitst; distance between tiffles divided by	habitat; distance between
		stream <7:1 (generally 5 to 7); variety of habitat is	between 7 to 15.	the width of the stream is between 15 to 25.	width of the stream is a ratio of >25.
. 4		key. In streams where niffles are continuous,			1440 02 - 23,
.   }	·	placement of boulders or other large, natural			
To the	SCORE	obstruction is important.			
		Parks - Mary 1	As a second second second		
de f	8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure	Moderately stable; infrequent, small areas of	Moderately unstable; 30- 60% of bank in reach has	Unstable; many croded areas; "raw" areas
P Sep	Notes determined	absent or minimal, little potential for future	erosion mostly healed over, 5-30% of bank in	areas of erosion; high erosion potential during	frequent along straight sections and bends:
Parameters to be evaluated broader then serreduced	Note: determine left or right side by facing downstream.	problems. <5% of bank affected.	reach has areas of erosion.	floods.	obvious bank sloughing; 60-100% of bank has
be ey	SCORE(LB)	The second	end the second of the second production of the second of t		erosional scare.
erato	SCORE(RB)	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1			9
13 met	9. Vegetative Protection (scoré	More than 90% of the streambank surfaces and	70-90% of the streambunk surfaces	50-70% of the streambank surfaces	Less than 50% of the streambank streambank
Ā	each bank)	homediate riparian zone covered by native	covered by native vegetation, but one class	covered by vegetation; disruption obvious;	covered by vegetation; disruption of streambank
	1	vegetation, including trees, understory shrubs,	of plants is not well- represented; discuption	patches of bare soil or closely cropped vegetation	vegetation is very high;
		or nonwoody macrophytes, vegetative	evident but not affecting full plant growth potential	common; less than one- half of the potential plant	removed to 5 continueters or less in
l		disruption through	to any great extent; more than one-half of the	stubble beight remaining.	average subble height.
		minimal or not evident; almost all plants allowed to grow naturally.	potential plant stubble beight remaining.		
	SCORE(LB)	- STAN TRANSPORTA		with a second second second	A Comment
	SCORE (RE)				
	10. Riparian	Width of riparien zone >18 meters; human	Width of riperian zone 12-18 meters; human		Width of riparian zone <6
	Vegetative Zone Width (score each	activities (i.e., parking	activities have impacted zone only minimally.	activities have impacted	meters: little or no riparian vegetation due to
	bank riparian zone)	lawns, or crops) have not impacted zone.	was only managery.	zone a great deal.	htman activities.
	SCORE (LB)		1 mm 1 mm 1 mm 1 mm 1 mm 1 mm 1 mm 1 m		
	SCORE (RB)				

Total Score









Station	SFP1A

EPT Taxa	3.00
Total Taxa EP	5.00
Abundance	117.00
Total PT	39.00
Total Chironomidae	77.00
Total Scrapers	0.00
Total Ephemeroptera	0.00
Total Hydropsychidae	19.00

	HBI (Family)	5.05	
		591.00	
	FFG #	26	
ŀ		82.05	
	% Top two dominant taxa		
	t Taxa #	96.00	
	Two Dominant Tax		
		65.81	
	% Chironomidae		
ı		0.00	
	% Scrapers		
ı		17.09	
	% PT less Hydropsychidae		
		0.00	
	e		
	% Ephemeropter		

SED1A

<b>ASCI Metrics (Truncated)</b>	22.73	27.27	0.00	48.02	0.00	34.19	25.94	72.78
VASCI Metrics vs. Standard VASCI Metrics (Truncated)	22.73	77.27	0.00	48.02	0.00	34.19	25.94	72.78
	Number of Taxa	Number of EPT Taxa	Percent E	Percent PT Less Hydropsychidae	Percent Scrapers	Percent Chironomidae	Percent Two Dominant	Hilsenhoff Biotic Index

28	28.86
Final VASCI	v VASCI

### Benthic Macroinvertebrate Laboratory Bench Sheet

Station ID:	SFPIA	Sample Subsorted by:	WRB	Date Subsorted:		
StationName:		# of Grids subsorted:				Ī
Date Sampled:	11/05/12/17	3 Total # of Subsorted Insects:			·	
Sampling Method:		Sample Identified by:		Dete Identified:	and the second second second	
		TAXON	#	of larvae	Total # of Organisms	# to Ref.Coll.
1	Chiconom	done	LIKE THE	HAT LAST IN LAST SHEET WAS	77	]
2	Capmidae		LANT DIV	<u> </u>	9	
3	Hydropsiya	nda Cheumatopeach	MUTHIN		IS	
4	.0 1	nda Cheumatopeyere Ceratopsych	114		4	
5	Simuluda	<u>e</u>	<u>                                     </u>		1	
6 ·	Leuctrida	Levotra	UKUKI		11	
7					**************************************	
8						
9						1
10		·				
11						
12						
13						
14			· .			T-11-11
15					·	"
16	<b></b>					,
17	······				·	
18	·					
19						
20	·					
21	·					
22						
22 23						
24						
25						
		TOTALS			117	

#### Sub-sample and Sample Reduction

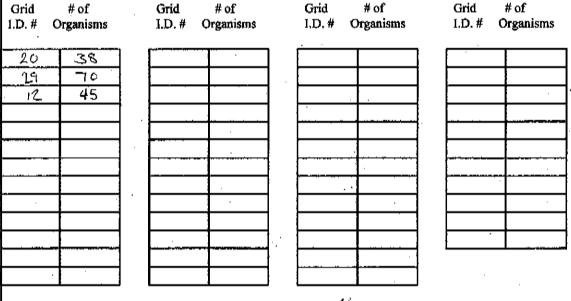
(per SOP)

### Sub-sample and Sample Reduction Sheet

Organisms found in first grid = 3+ (Grid # 27)

A minimum of 4 grids must be picked.

Magnifying visors are to be used when sub-sampling.



Total organisms = 190 Total grids = 4

 $\underline{IF}$  after picking, there are >121 organisms, then return picked sample to 15-30 grid tray and remove grids (per SOP) to reduce sample to 121 organisms or less. Record data below.

Total # of organisms retained = 117

Grids removed to reduce sample to 121 organisms or fewer = 5

Percentage of grids retained for sample (to total grids) =

(# of grids from original sample {A})

(% of grids retained)

(final corrected # of grids from original sample)

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SECET (FRONT)

STREAM NAME 5F	Pound	LOCATION	Rom	a Crossing	nt Ponce
	VERMILE	STREAM CLA	SS		
	DNGDNG	RIVER BASIN	<u> </u>	· · · · · · · · · · · · · · · · · · ·	
STORET#		AGENCY			
INVESTIGATORS O	LTM			-	
FORM COMPLETED BY	on	DATE 1/	5/1/2	REASON FOR SURVE	. · ·
WEATHER CONDITIONS	Now		Past 24	Has there been a heavy ra	ain in the last 7 days?
CONDITIONS	Cl storm	(beavy rain)		Air Temperature	
	C rain (s	steady rain) s (intermittent)	0	Other Comperature	-
	, %□ %d	loud cover ear/suony	<u>"</u> "		
SITE LOCATION/MAP			to areas seems	iled (or attach a photograp	h)
	map or me at	marcate t	= and = attl	штага и риогодияр	
	1			Contract of	
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			7 grā /	$I_{\sim}$	<u> </u>
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.,	١			Com.	B 321-1
i				WY(	R) (1060)
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	٠.				11、原源17、19
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		1		.~m∦ :	
	· ·				,
	1.	•	ı		
STREAM	Stream Subsystem	_		Stream Type	
CHARACTERIZATION	Stream Subsystem Perennial Clinton		ial	Stream Type  Coldwater C Warmw	:
	Stream Origin O Glacial O Non-glacial montane	O Spring-fe	rd <sup>v</sup>	Catchment Area	km²
	O Non-glacial montane O Swamp and bog	Spring-fr Mixture Other	or origins	· · · · · · · · · · · · · · · · · · ·	
		<u> </u>		-	

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

			and Daw	anduse mercial	Local Watershed M	S Pollution		
ľ	WATERSHED FEATURES Protes Comm Field/Pasture Cl Indust Agricultural Other					ome potential sources		
		<b>Y</b>			Local Water and E.	ite Ci Heavy		
ECPAR VEGET (18 met	IAN FATION er buffer)		cate the dominant type ocs mant species present	shrubs	dominant species present			
INSTRI FEATU	eam Tres	Estin	nated Stream Width	<i>®0</i> <u> </u>	Canepy Cover	rtty shaded □ Shaded m		
		Area	ing Reach Area in km² (m²x1000)	m² km²	Proportion of Reach	Represented by Stream		
			·	т	C Rime Z S %			
ļ	0 0		ce Velocity	_ш/sec	Channelized 🗆 Y	cs ZINo		
<u> </u>	<del></del>	<u> </u>	,		Dem Present 🗆 Y	•• OM		
LARGE	WOODY	LWD	m		<u> </u>			
		Denst		m³/km² (LW)	/ reach area)			
AQUAT	1C	India	·			·		
VEGETA	ATION	Roc	sted emergent	ed record the Rooted submor Affached Algae	dominant species present gent	O Free floating		
		0	unit species present	Allached Algae				
,			· .	<del></del>				
	<del></del>	* OF ILO	n or the reach with aqu	of the reach with aquatic vegetation 2/2 %				
WAIER	QUALITY	Specif	erature° C ic Conductance ved Oxygen	_	Water Odors  Z Normal/None			
! ' !		<b>рН</b>	lity					
			strument Used	·	Turbidity (if not mean O'Clear U'Slightly to O'paque U Stamed	eured) urbid		
SEDIME: SUBSTRA	NT/ ATE	Offers 2 Nove 1 Oben	nal Sewage nical Anascobic	Petroleum O None	troloum			
<del></del>		On DAbsect	nt 🗆 Slight 🕒 Modera	ec 🔾 Profi	Are the underfides by	Ch are not deen be see badded.		
ïNC	ORGANIC SUBS (should ad	TRATE d up to 1	COMPONENTS 190%)		ORGANIC SUBSTRATE (	COMPONENTS		
Substrate Type	Diamete	r	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area		
Bedrock		,		Detritus	sticks, wood, coarse plant			
Boulder	> 256 mm (10")			1	materials (CPOM)	70		
Cobble	64-256 mm (2.5°	10")	50	Muck-Mud	black, very fine orespic	<del></del>		
	2-64 mm (0.1"-2.	5")	30	1	black, very fine organic (FPOM)			
Tavel								
	0.06-2 <del>uun</del> (gritty)	- (vii 202)			<del>                                     </del>			
Sand	_		10	Marl	grey, shell fragments			

#### HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
station# SFPIA rivermile	STREAM CLASS
LATLONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 1/5/12 REASON FOR SURVEY
	TIME AM (PM )

	Habitat		Condition	: Category	
ł	Parameter	Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Oreater than 70% of substrate favorable for opifiumal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage	adequate habitat for maintenance of populations; presence of additional substrate in the	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitet; lack of habitet is obvious; substrate unstable or lacking.
		to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and not transient).	form of newfall, but not yet prepared for colonization (may rate at high end of scale).		
	SCORE				
mpling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	GraveL.cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
		of piche space.			
3	SCORE	4.24. Bullian 1983 Fe		1924 - 1 19 <u>11</u>	
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow- deep, slow-shallow, fast- deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if first shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
2	SCORE				14.2
Pr	4. Sediment Deposition	Little or no enlargement of islands or point burs and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bur development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment
				pools prevalent.	deposition.
	SCORE				
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE				

## HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

	Habitat		Conditi	on Category	
	Parameter	Optimal	Suboptimal	Marginal	Роог
	6. Channel Alteration	Chamelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not	Chamelization may be extensive; embankments or shoring structures present on both banks; and 40 to 30% of stream reach channelized and disrupted.	Banks shored with gas or cornent; over 80% the stream reach channelized and disrupted. Instream habitat greatly aftered removed entirely.
	SCOPE	anga ika sa	present.	*	
	SCORE	ilian ya da walio da kara wa kata wa k			
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where	Occurrence of riffics infrequent; dishance between riffics divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water shallow riffles; poor habitat; distance between
opitag reach		riffles are continuous, placement of boulders or other large, natural obstruction is important.			
1 680	SCORE			Table 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
rarameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of crossion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over, 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high exosion potential during floods.	Unstable; many croded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughin 60-100% of bank has
a co os es	SCORE(LB) SCORE(RB)				crosional scars.
	9. Vegetative Protection (ecore each bank)	More than 90% of the streambank surfaces and humediate riperian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	streambank surfaces covered by native vegetation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent, more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-balf of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streamban vegetation is very high; vegetation has been removed to 5 centimeters or less in average shibble height.
	—· /			The state of the s	
1 V b	O. Riparian Vegetative Zone Vidth (score cach sank riparian zone) CORE(LB)	activities (i.e., parking	Width of riparism zone 12-18 meters; human activities have impacted zone only minimally.	Width of riperian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone of meters: little or no riparian vegetation due a human activities,
\$	CORE (RB)	55.5		The second second	
	Score		The man the committee of the		The same of the same

uc	
Station	SFP2

27.00 0.00 0.00 43.00 60.00 104.00 6.00 104.00 6.00	Total Hydropsychidae	Total Ephemeroptera	Total Scrapers	Total Chironomidae	Total PT	Abundance	Total Taxa	EPT Taxa
				43.00	00'09			4.00

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	Two Dominant Taxa # %Top two dominant taxa FFG #	HB	l (Family)
0.0	31.73	00'0	41.35	00.99	63.46	464.00	4.46
SFP2							

Metrics (Truncated)	27.27	36.36	0.00	89.13	0.00	58.65	52.80	81.45
VASCI Metrics vs. Standard VASCI Metrics (Truncated)	27.27	36.36	0.00	89.13	0.00	58.65	52.80	81.45
	Number of Taxa	Number of EPT Taxa	Percent E	Percent PT Less Hydropsychidae	Percent Scrapers	Percent Chironomidae	Percent Two Dominant	Hilsenhoff Biotic Index

Final VASCI	<b>7</b>
VASCI	43.21

### Benthic Macroinvertebrate Laboratory Bench Sheet

Station ID:	SFP-Z	Sample Subsorted by:	1	Date Subsorted:	<u> </u>	
StationName:		# of Grids subsorted:		· · · · · · · · · · · · · · · · · · ·		ľ
Date Sampled:	1 1	Total # of Subscried Insects:				
Sampling Method:		Sample Identified by:		Date Identified:		
4		TAXON	# of	larvae	Total # of Organisms	# to Ref.Coll.
1	Topolida	<u>e</u>			1	,
2	Rhyaco	philodae Physeophila	i			
3	1		UKHTIIN		14	
4	J 1	Chematopsyche		., , ','.,,,",''	13	
5	Chironor	nidae		W WING CHON	43	
6		engidae Staphoptone	LAT INI		9	
7	Caprudae		HOTELETHAN LINE	<b>N</b>	2.3	
8						
9	,					<del>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</del>
10		,		······································	-	
11		,				
12	,	'				
13						····.
14						1
15 : .				, '	-	" "
16			· .			
17						
18						
19						,
20						
21						
22						
23		· ·				
24				٠.		•
25			""			
		TOTALS			104	

#### Sub-sample and Sample Reduction

(per SOP)

1	Sub-samp	le	and	Sam	ple	Red	luction	Sheet

Organisms found in first grid =  $\frac{2.8}{}$  (Grid #  $\frac{30}{}$ )

A minimum of 4 grids must be picked.

Magnifying visors are to be used when sub-sampling.

Grid # of I.D. # Organisms	Grid # of I.D. # Organisms	Grid # of I.D. # Organisms	Grid # of I.D. # Organisms
22 32 21 09 26 35			
	-		

Total organisms = 104 Total grids = 4

 $\underline{IF}$  after picking, there are >121 organisms, then return picked sample to 15-30 grid tray and remove grids (per SOP) to reduce sample to 121 organisms or less. Record data below.

(# of grids from original sample {A}) (% of grids retained)

(final corrected # of grids from original sample) STP-2

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME SE	Pariel	LOCATION (	com bolow	conf lat creek
STATION# SFP Z RI		STREAM CLASS		
	NG	RIVER BASIN	·	
STORET#	1,4	AGENCY		
INVESTIGATORS	2 JM			<u> </u>
FORM COMPLETED BY	on	DATE //5/AM	REASON FOR SUI	RVEY
WEATHER CONDITIONS	Now	Past 2	4 Handhere been a bes	vy rain in the last 7 days?
COMPATIONS	g storm	(beavy rain)	Air Temperature	• °c
· .	D shower	(steady rain)	Other	
	% — / % c	cioud cover 🚨	% VIAG	
SITE LOCATION/MAP		<del></del>	zampled (or attach a photo	парр)
				·
	0	et los	on man	$\boldsymbol{\rho}$
	1. "			
	$\bigcap_{i \in \mathcal{I}_i} \mathcal{I}_i$	•		
	Pics	<b>&gt;</b>		
	1	·		
				_
	। ४। - ४	$\varphi$	NH	8.4
	Tah -		7 T	
	Thin	<b>E</b> ' .	· · / _	an
			$ \sim$ $\sim$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	) -1.0
1	•		Com	1 1947
n - 1	• • • • • •		, ÇON	$\alpha$ $\alpha$
			<del></del>	_
			101	W 1711
			, - ,	1 -14
			•	
			•	
STREAM CHARACTERIZATION	Stream Subsystem Perennial into	ermittent 🗅 Tidal 🚿	Stream Type	ermwater
COMMACTERIZATION	Stream Origin	• •	Catchment Area	kan <sup>2</sup>
<b>1</b>	☐ Glacial ☐ Non-glacial mentane	O Spring-fed Mixture of origins		
	Swamp and bog	6 Other	<b>-</b> .	
	<u> </u>			

## PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATE	ershed Ures		lominant Surrounding I west I Com eld/Pasture I Indu gricultural I Othe sadential	mercial	Local Watershed Management of Solutions cources  Local Watershed Es	ome potential sources
·		<del></del>	<del></del>	<del></del>	□ None Modera	t 🗅 Heavy
VEGE (18 mc	HAN TATION ter buffer)	dom	eate the dominant type s ces mant species present	record the	dominant species present	Herbaccous
INSTR FEATU			nated Reach Longth nated Stream Width	100m		arthy shaded 🖸 Shaded
1		Samp	pling Reach Area	m²	High Water Mark	<u>/ (/-2</u> m
1		Area	In km² (m²x1000)	km²	Proportion of Reach Morphology Types	Represented by Stream  ORum_35_%
		Estin	nated Stream Depth	n	Ci Riffie 66	□Run_ <u>35</u> %
		Sarts	ice Velocity alweg)	_in/sec		* Mio ROB
LARGE	E WOODY	LWD	m²	· · · ·		2 110 10000
DEBRI	s			m²/km² (T.XVI	)/ reach area)	•
AQUAT	пс	India		·		· · · · · · · · · · · · · · · · · · ·
	ATION	O Rox	xed emergent (1) thing Aigne (1)	nd record the Rooted submer Attached Algae	dominant species present gent U Rooted floating	☐ Free floating
Į	. '		ant species present			
		R .	on of the reach with aqu	atic vegetation	45%	<del></del>
WATER	QUALITY		erature °C			
	•	Specif	le Conductanco	-	Water Odors 2 Normal/None C Sev 2 Petroleum 3 Fishy	vage O'Chemical O'Cher
·		16 <b>X</b> 8X	lity	•	Water Surface Offs  O Shok O Shoen ( None O Other	□ Çlobs □ Plecks
· · · · · · · · · · · · · · · · · · ·			atroment Used	<u> </u>	Tarbidity (if not mess Clear Slightly to Opsque O Stained	ured) whid □ Turbid □ Other
SED)ME SUBSTR		Ostors 21 Norm 12 Chen 13 Other	nical Anacrobic	O Petroleum O None	Deposits ☐ Sludge ☐ Sawdust ☐ Relict shells	Yother Super Wishard
·		Off OrAbea	ut □ Slight □ Moders	ate 🚨 Profi	Looking at stones whise are the undepdides blacked by Yes No	th are not deeply embedded, ck in color?
INC	ORGANIC SUBS	T1D A T1D	COMPONENTS			
	(should ad	id up to	100%)	1	ORGANIC SUBSTRATE C (does not necessarily add	OMPONENTS up to 100%)
Substrate Type	Diamete	r	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Ares
Bedrock			5	Detritus	sticks, wood, coarse plant	
Boulder	> 256 mm (10")		10	1	materials (CPOM)	15
		105	50	Marsh Marsh	blode vi- C	
Cobble	64-256 mm (2.5°	-10")	5 <i>0</i>	Muck-Mud	DUNCK, YOUY DING OTRAINIC	
Cobble Gravel	64-256 mm (2.5° 2-64 mm (0.1°-2,		30	MINIK-MINI	black, very fine organic (FPOM)	
Gravel		5)	30	Marl		
	2-64 mm (0.1*-2.	5)	30		(FPOM) grey, shell fragments	

#### HABITAT ASSESSMENT FIELD DATA SHEET—HIGH CRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION# 4FD 2 RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 11/5/1 Z REASON FOR SURVEY

Ţ.	Habitat		Condition	n Category	
1	Parameter	Optimal	Suboptimal	Marginal	Poor
	Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifamal colonization and fish cover, unix of snags, submerged logs, undercut banks, cobble or officer	adequate habitat for maintenance of populations; presence of	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or respoyed.	Less than 20% stable habitat; lack of habitat is obvious; substrate nostable or lacking.
		stable habitat and at stage to allow full colonization potential (i.e., loga/snags that are <u>not</u> new fall and not transient).	additional substrate in the fram of newfall, but not yet prepared for colonization (may rate at high end of scale),		
	SCORE				
ampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by froe sediment. Layering of cobble provides diversity	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
Į.	SCORE	of niche space.			
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow), first-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
act act	SCORE				
ď	4. Sediment Deposition	Little or no enlargement of ialands or point bens and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, send or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, and or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE			pools prevalent.	
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE				

## HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat		Condit	lon Category	
Parameter	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past chameization, i.e., dredging, (greater than past 20 yr) may be present, but feech channelization is not paracut.	Chamelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabi or coment; over 80% of the stream reach channelized and disrepted. Instream habitat greatly altered o removed entirely.
SCORE				
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous.	Occurrence of riffies infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide	Generally all flat water shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	placement of boulders or other large, natural otherspection is important.			
BCOKE	Table 10 Carlotte			
8. Bank Stability (score each bank)  Note: determine left or right side by facing downstream.	Banks stable; evidence of crosion or bank failure abscut or minimal; little potential for future problems, <5% of bank affected.	Moderately stable; infrequent, small areas of crosion mostly healed over. 5-30% of bank in reach has areas of crosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many croded areas; "raw" areas frequent along straight acctions and bends; obvious bank alonghing; 60-100% of bank has
SCORE (LB) SCORE (RB)				crosional scars.
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bere soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambenk surfaces covered by vegetation; disruption of streambenk vegetation is very high; vegetation has been removed to 5 contimeters or less in average stubble height.
SCORE (LB) SCORE (RB)			Antig Conservation (Conservation of the Conservation of the Conser	
10. Riparian Vegetative Zone Width (score each bank riparian zone)	>18 maters; human activities (i.e., parking	Width of riperion zone 12-18 meters; human activities have impacted zone only minimally.	12 motors; human activities have impacted	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE(LB) SCORE(RB)				

Yotal	SAAMA	

Station	7	ŕ

Total Scrapers Total Chironomidae Total PT Abundance Total Taxa EPT Taxa	7.00         20.00         51.00         109.00         15.00         8.00	
Total Chironomidae	.00	
	12.00	
Total Hydropsychidae	9.00	

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	wo Dominant Taxa # % Top two dominant taxa	FFG #	HBI (Family)
11.01	1 38.53	6.42	18.35	46.00	42.20	378.00	3.47
3CI							
	VASCI Metrics vs. Standard	VASCI Metrics (Truncated)					
Number of Taxa	68.18						
Number of EPT Taxa	72.73						
Percent E	17.96						
Percent PT Less Hydropsychidae	108.24	100.00					
Percent Scrapers	12.45						
Percent Chironomidae	81.65						
Percent Two Dominant	83.52						
Hilsenhoff Biotic Index	90.96						

### Benthic Macroinvertebrate Laboratory Bench Sheet

Station ID:	<u> </u>	Sample Subsorted by:	1	Date Subsorted	<del></del>	·
StationName:		# of Grids subsorted:		TORKE CORSOLIEU		· ·
Date Sampled:		Total # of Subsorted Insects:			<del> </del>	<u> </u>
Sampling Method:		. Sample Identified by:		Date Identified:		<b></b>
224 2 7 2 44	<u> </u>		<u> </u>	1		
<b>CK</b>		TAXON	# of	iarvae	Total # of Organisms	# to Ref.Col
1	Tipolidae	<u>.                                    </u>	<b>E</b> MINI		8	
2	Chironomi		TH MUM IN	· · · · · · · · · · · · · · · · · · ·	20	-
3_	Elmidae		III		3	<del></del>
4 '	Simulada	· _	iur)	<del></del>	6	
5	Psepheni	· · · · · · · · · · · · · · · · · · ·	L		-	
6	Philo cotou	adae Commarco	<b>M</b> 1		6	
7	Hentasami	Maccafeithum	())		2	
B	Butidae	Acentrella/Bactis	<del>                                     </del>	<del></del>	7	
9	Hydropsy	unda Chemitosij		<del></del>	4	
10	3 ( )	1.7	W	· · · · · · · · · · · · · · · · · · ·	5	
11	Levetrida		THE THE THE THE	ilk i	26	<u>'</u>
12	Caprildae		<u>istanistani</u> Drin	K) L	8	···········
3	Ephemerell		)\ )\		2	<del></del>
4		er Nemavia	II		2	<del></del>
5	Collembol		Ur(ii		. 7	<del>: , ,i , .</del>
6	Asellidae	. / .	<u></u>			
7	·			<del></del>		
8		/				
9			······································		<u> </u>	
0				·		
1			<del>_</del> . , . <del></del> .		<del></del>	
2	-		· · ·			···
3				<u>-</u>		<del></del>
4	· · · · · · · · · · · · · · · · · · ·	***************************************	1			<del></del>
5	-					
		TOTALS	<del></del>	<del></del>	109	

### Sub-sample and Sample Reduction

(per SOP)

Su	b-s	am	ple	and	Sam	ple	Rec	lucti	ОП	Shee	ŧ

Organisms found in first grid =  $\frac{45}{100}$  (Grid #  $\frac{7}{100}$ )

A minimum of 4 grids must be picked.

Magnifying visors are to be used when sub-sampling.

Grid # of I.D. # Organisms	Grid # of LD, # Organisms	Grid # of I.D. # Organisms	Grid # of I.D. # Organisms
9   05   17   29   9   18			
Total organisms =	09 Total	grids = 5	
IF after picking, there remove grids (per SO) Total # of organisms Grids removed to redu Percentage of grids re	P) to reduce sample to retained = 109 are sample to 121 org	s, then return picked sample to 121 organisms or less. Re ganisms or fewer = total grids) =	e to 15-30 grid tray and ecord data below. —

(final corrected # of grids

from original sample)

(# of grids from

original sample (A))

(% of grids

retained)

50-1

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME SALE	+ Creek	LOCATION 150 m US CONS ROOFCY
	ERMILE	STREAM CLASS
LAT LO	VG	RIVER BASIN
STORET#		AGENCY
investigators On	- OM-	
FORM COMPLETED BY	on	DATE V 5 11 Z AM PM REASON FOR SURVEY
WEATHER CONDITIONS	Now	Past 24 Has there been a heavy rain in the last 7 days? hours \square \text{No} \square \text{No}
	O ston	m (heavy rain) C Air Temperature \( \sum_{\circ}^{\circ} \) C
	C) abowe	ers (intermittent)
		clear/sounty D
SITE LOCATION/MAP	Draw a map of the s	nite and indicate the areas sampled (or situch a photograph)
	at	t los, on map
		d /
		+1 Cray fish
		0.0
Í		
	•	
		81
	C. C.	$\rho_H$
	Pic	<b>S</b>
		00 9.2
	×7-9	7.
	0,	
	Tohoma	A 1101
	Thisia	- 10P (gra)
		Temp 9.2
		Temp 9.2
		1emp 1.2

Spring-fod
Mixture of origins
C) Other

Stream Subsystem

Perennial Intermittent Cl Tidal

Stream Origin

Glacial
Non-glacial montane
Swamp and bog

STREAM CHARACTERIZATION

Warmwater

Catchment Area

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATE	ershed Ures		tominant Surrounding rest   Con- cld/Pasture   Inch gricultural   Och	Landuse uncarrial petrial er	U Obvious sources	ome potential sources
		D/R	aidential	-	Local Wateraled E	resion atc D Heavy
RIPAR VEGE (18 me	IIAN TATION ter buffer)	Ind dom	ste the dominant type bes mant species present	oud record the chrubs	dominant species present	Herbaceous
INSTR FEAT		Kstir	nated Reach Longth nated Strang Width Ding Reach Area	Z, <u>5</u> <sub>m</sub>	Caropy Cover Fatty open. Q P High Water Mark	antly shaded O Shaded
	· 	Area Estin	in km² (m²x)000) nated Stream Depth	m²km²n	Proportion of Reac Morphology Types O Riffic 62 %	Represented by Stream
		Surfa (at th	ce Velocity siweg)	_m/sec	Channelized O Y  Dam Present O Y	es ANO LNB
DEBRI	S WOODY	LWD Denat	ty of LWD	m²/km² (LWI		- PNO Roal
AQUAT VEGET	IC ATION				dominant species present	O Free floating
	. '	domin	ant species present n of the reach with aqu	<u> </u>		
WA'TER	QUALITY	Temp Specifi	orsture ° C ic Conductance /ed Oxygen		Water Odors	wago O Onemical O Other
-		pH Turbid			Water Surface Office Shoon None Other	
<u>,_</u>		WQ In	strument Used		Turbidity (if not mean of Clear Slightly to Opeque O Staned	sured) urbid Crushid Crother
SEDIME SUBSTR		Oglers D Norm C Ober D Other	ucal D Armerobie	O Petroleum O None		O Paper tiber Sand
<u>.</u>		Offis D'Absor	st O Slight O Moders	ste □ Profi	Looking at stones white are the undersides blue of No.	ch are not deeply embedded, ck in color?
INC	ORGANIC SUBS	TRATE ( ld up to 1	COMPONENTS 90%)		ORGANIC SUBSTRATE (	COMPONENTS
Substrate Type	Diameter	r	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock				Detrins	sticks, wood, coarse plant materials (CPOM)	
Soulder	> 256 mm (10")		5	<u>l</u>	materials (CPOM)	30
Cobble	64-256 mm (2.5"		40	Muck-Mud	black, very fine organic	
Tavel	2-64 mm (0.1"-2,		Чо	<u> </u>	(FPOM)	
and	0.06-2mm (gritty)		10	Marl	grey, shell fragments	
Silt	0.004-0,06 mm		5			
lay	< 0.004 mm (slick	0				

### HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION# SC   RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORE	
FORM COMPLETED BY	DATE 175/ Z REASON FOR SURVEY

· [	Habitat		Condition	n Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	1. Epifaunai Substrate/ Available Cover	Creater than 70% of substrate favorable for epifamual colonization and fish cover; neix of snags, submerged logs, underent banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
1	SCORE				W.
Parameters to be evaluated in sampling reach	2. Embeddedness	Chavol, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine acdiment.	Cravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
T page	SCORE				
eters to be evalue	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
E E	SCORE				
A.	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions,	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to
1				constrictions, and bends; moderate deposition of pools provalent.	substantial sediment deposition.
	SCORE	and the second second		house treasure	
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel, or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE				

	Habitat		Condit	ion Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Chamelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be procest, but recent channelization is not pastent.	Chamelization may be extensive; embaukments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabior or cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altexed or removed entirely.
	SCORE			<u> </u>	
ach	7. Frequency of Riffies (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous,	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
iling re		placement of boulders or other large, natural obstruction is important			
ğ	SCORE				
ď,	- · ":				
raremeters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of crosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of crosion mostly healed over. 5-30% of bank in reach has areas of crosion.	Moderately unstable; 30-60% of bank in reach bas areas of erosion; high crossion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank aloughing, 60-100% of bank has
to be er	SCORE(LB) SCORE(RB)				erosional scars.
	9. Vegetative Protection (score each bank)	grazing or mowing minimal or not evident;	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambenk surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
- 1	SCORE(LB) SCORE(RB)				
17	Vegetative Zone Width (score each sank riparian zone)	activities (i.e., parking	Width of riperian zone 12-18 meters; human activities have impacted zone only minimally.	12 meters; human activities have impacted	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
1	CORE(LB)				

Total	Score	
XULAL	Score	

Station	
RC1	

	00.9	(Á),	4.53
PT Taxa		HBI (Family)	
Total Taxa EPT Taxa	11.00		462.00
Tota	00	FFG <sup>3</sup>	72.55
	102.00	ıant taxa	72.
nce		vo domir	
Abundance		Two Dominant Taxa # %Top two dominant taxa FFG #	
	41.00	Taxa #	74.00
Ţ		ominant	
Total P	0	Two Do	4
Total Chironomidae Total PT	54.00	idae	52.94
al Chiron		% Chironomidae	
Tota	00.0	2 %	00.0
	)		)
Scrapers		ers	
Total Scr		% Scrapers	
	2.00	dae	27.45
roptera		ropsychio	
Total Ephemeroptera		% PT less Hydropsychidae	
Total	00	% PT	1.96
	13.00		1.
idae		а	
dropsych		phemeroptera	
Total Hy		% Epher	

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	Fwo Dominant Taxa # % Top two dominant taxa	FFG #	HBI (Family)
1.96	27.45	0.00	52.94	74.00	72.55	462.00	4.53
RC1							
	VASCI Metrics vs. Standard VASC	VASCI Metrics (Truncated)					
Number of Taxa	50.00	20.00					
Number of EPT Taxa	54.55	54.55					
Percent E	3.20	3.20					
Percent PT Less Hydropsychidae	77.11	77.11					
Percent Scrapers	0.00	0.00					
Percent Chironomidae	47.06	47.06					
Percent Two Dominant	39.62	39.67					
Hilsenhoff Biotic Index	80.45	80.45					

	44.00	
Final VASCI		
	44.00	
Raw VASCI		

### Benthic Macroinvertebrate Laboratory Bench Sheet

Station ID:	20≠	Sample Subsorted by:		Date Subscried:		
StationName:		# of Grids subsorted:				<del>                                     </del>
Date Sampled:	11	Total # of Subsorted Insects:				
Sampling Method:		Sample identified by:	***************************************	Date Identified:		
100 0 0 0 000	<b>}</b>					
					Total # of	# to
		TAXON	  - #cf	larvae	Organisms	
1	Tipolida		n e		2	
2	Chironon		Jeff 184	or have sale her sale	54	
3	Emoidid		1	A 100 May 100		
4	1 )	middle Chimarra	tiv	<del>- , , , , </del>	3	
5		chidae Quematopsycle	<del> </del>		13	
6	Capnidae	Allocophia	With talki		20	
7	Gomphid	·e	1		1	
8	Similida		Į		1	
9 .		ae leuctra	111	<del> </del>	3	
10		e Acentralla Bustis	- E-E-Lau		2.	
11		·	Ŋ		2	
12		*				
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14				. ,	<del></del>	
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16						
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18						
19	: :					
20						
21					·	
22				1		
22 23						-
24			f.	\		•
25		•				
_		TOTALS			102	

### Sub-sample and Sample Reduction

(per SOP)

Cur	h	com	ماد	han	Com	nla	Dar	luction	Cheet
IJЦ	v	·SAIII	μıς	UUK	<b>Эаш</b>	րբ	Ver	iuchon	Office

Organisms found in first grid = 13 (Grid # 5)

A minimum of 4 grids must be picked.

Magnifying visors are to be used when sub-sampling.

Grid # of I.D. # Organisms	Grid # of LD.# Organisms	Grid # of I.D.# Organisms	
15 16			
1 11			
28 16			
12 6			
18 23			
			<del> </del>
			<u> </u>
Total organisms =	102 Total gri	ids= <u>8</u>	

<u>IF</u> after picking, there are > 121 organisms, then return picked sample to 15-30 grid tray and remove grids (per SOP) to reduce sample to 121 organisms or less. Record data below.

Fotal # of organisms re Grids removed to reduce		tenieme or fewer =
Percentage of grids reta		
х х		=
(# of grids from original sample {A})	(% of grids retained)	(final corrected # of grids from original sample)

RC 4

## PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME PA	Crach	LOCATION	150 m	~ U5	<u>Cong 51</u>	مك المحمد	oek.
STATION# RC   RI	VERMÆE	STREAM CLAS	SS			·	
LATLO	NG	RIVER BASIN	- M				
STORET#		AGENCY					<del></del>
INVESTIGATORS	n IM		/		<u> </u>		
FORM COMPLETED BY	012	DATE W/5/	Z AM (PM	REASON	FOR SURVEY		
WEATHER CONDITIONS	D pain ( bhower	(heavy rain) (steady rain) s (intermittent) loud cover car/sumy	Past 24 hours	DALes 🗀	en a heavy rain is No atoure <u>/                                   </u>	the last 7 day	· · · · · · · · · · · · · · · · · · ·
STE LOCATION/MAP	Draw a map of the sit	te and indicate the					
	Pics				PH	8,0	• •
	93-98 Tohor	<b>3</b>			DO	9.2	
	Ipro				Cond	1224	1
				, ,	Tay	D 9	,4
STREAM CHARACTERIZATION	Stream Origin Glacial Non-glacial montane	conittent C Tide		Stream Type Cl Coldwater Catchment A	Warmwater	m²	
	C) Swamp and bog	Other				-	

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATE	RSHED VRES	部	ominant Surrounding I rest Com skd/Pashno Chidu giculmus C Othe	mercial etrial	Local Watershed M I No evidence Z So I Obvious sources	one potential sources
. [				•	Local Watershed Er	osion te 🔾 Heavy
RIPAR VECET (18 met	IAN FATION er buffer)		ate the dominant types sees mant species present	nd record the Shrubs	dominant species present	<del></del>
INSTRI FEATU	EAM RES	Ketin	nated Reach Leagth nated Stream Width Dibig Reach Area		Canopy Covor Dearly open Merk High Water Mark	m
			in km² (m²x1000) nated Stream Depth	km²	Proportion of Reach Morphology Types Il Riffle // Il Pool	Represented by Stream
<u> </u>		Surfa (at th	ce Velocity Alweg)	_m/sec	Channelized O Ye	s Ze No
LARGE DEBRIS	WOODY	LWD Densi		_m²/km² (LW1		
AQUAT VEGET		Indies D Roc D Flor	ate the dominant type at ted emergent uting Algae	ad record the Rooted submer Attached Algae	dominant species present gent G Rooted floating	☐ Prec floating
			ant species present n of the reach with aqu	·		<del></del>
WATED	QUALITY .			and vegetation	<u>20</u> %	<u>.                                    </u>
· · · · · · · · · · · · · · · · · · ·	QUMAII .	Specif	crature°C ic Conductance ved Oxygen		Water Odors Zi Normal/None D Sev Di Petrolcum Di Fishy	rage D'Chemical D'Other
		₽Ħ	Hry	• .	Water Surface Offic O Shok O Sheen ( O'None O Other	
		WQ1n	strument Used	<u> </u>	Turbidity (if not mess Clear G Slightly n Opaque C Stained	ured) whid D Turbid O Other
SEDIMOLI Subsyr		Oders D'Nom O Chen O Othe	eical Anacrobic	Petroleum None	Deposits O Studge  O Sawdnei O Relict shells	Other Sand
<u>.</u>		Offe	nt 🗆 Slight 🗔 Modere	ite O.Profi	Looking at stones which are the undersides blacks O Yes O Yes	h are not desply ambedded, k in color?
nnc	ORGANIC SUBS	TRATE	COMPONENTS		ORGANIC SUBSTRATE C	OMPONENTS up to 100%)
Substrate Type	Diamete	r	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
3edrock				Detritus	sticks, wood, coarse plant	
3ouldar -	> 256 mm (10")		0	]	materials (CPOM)	35
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic		
Fravel	2-64 mm (0.1"-2.5") 30		1	(FPOM)		
and	0.06-2mm (gritty	)	10	Marl	grey, shell flagments	
ilt	0.004-0.06 mm		1.0			
Jay	< 0.004 mm (slic	k)		[		·

#### HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION# RC \ RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 115#2 REASON FOR SURVEY

Г	Habitat		Condition	ı Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	1. Epifaunał Substrata/ Available Cover	Creater than 70% of substrate favorable for epifiumal colonization and fish cover; nex of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE				
sempling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine scriment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment,
ted l	SCORE		1 Mg	unione de la Company de la Com	
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth, regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitest regimes present (if fast- shallow or allow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually alow-deep).
aran	SCORE				
4	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools provalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE				
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is supposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	4			

### HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat		Conditi	on Category	
Paramete <sub>F</sub>	Optimal	Suboptimal	Marginel	Poor
6. Channel Alteration	Chamelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments, evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Chamelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabic or coment; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE				
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7/1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitst; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water of shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
	other large, natural obstruction is important.			
SCORE	4 - 9 - 2 - 2 - 2 - 2 - 2 - 2 - 2			
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; fittle potential for future	Moderately stable; infrequent, small areas of crosion mostly healed	Moderately unstable; 30- 60% of benk in reach has areas of erosion; high	Unstable; many croded areas; "raw" areas frequent along straight
Note: determine left or right side by facing downstream.	problems. <5% of bank affected.	over, 5-30% of bank in reach has areas of erosion.	erosion potential during floods.	sections and bends; obvious bank sloughing; 60-100% of bank has crossocial scars.
SCORE(LB) SCORE(RB)	and the second of the second o			
9. Vegetative Protection (score each bank)	macrophytes, vegetative discuption through grazing or mowing minimal or not evident;	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-balf of the potential plant	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation as very high; vegetation has been removed to 5 centimeters or less in average suibble height.
SCORE(LB) SCORE(RB)			III Tomas Karallan gekelik da Tempanya dalam	
bank riparian zone)	>18 meters; human activities (i.e., parking	Width of riperism zone 12-18 meters; human activities have impacted zone only minimally.	12 motors; human activities have impacted	Width of riparian zone <6 neters: little or no sparian vegetation due to numan activities.
SCORE(LB) SCORE (RB)				

Total Score \_\_\_

ROB

Station	

. Taxa	00'9	
Total Taxa EPT Taxa	12.00	
ndance	111.00	
Total PT Abu	88.00	
Total Chironomidae	15.00	
Total Scrapers	1.00	
Total Ephemeroptera	00:00	
Total Hydropsychidae	12.00	

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	wo Dominant Taxa # %Top two dominant taxa FFG # H	HBI (Family)
0.0	0 68.47	0.90	13.51	64.00	57.66 316.00	2.85
GF1						
	VASCI Metrics vs. Standard VASCI	VASCI Metrics (Truncated)				
Number of Taxa	54.55					
Number of EPT Taxa	54.55					
Percent E	0.00					
Percent PT Less Hydropsychidae	192.33	100.00				
Percent Scrapers	1.75					
Percent Chironomidae	86.49					
Percent Two Dominant	61.19					
Hilsenhoff Biotic Index	105.19					

Final VASCI	57.31	
Raw VASCI	09:20	

Benthic Macroinvertebrate Laboratory Bench Shee

Station ID:	GF1	Sample Subsorted by:				
StationName:		# of Grids subsorted:		Date Subsorted		
Date Sampled:	/ . /	Total # of Subsorted Inse				
Sampling Metho	d:	Sample Identified by:	Kas:			<u> </u>
				Date Identified:		
		TAXON			Total # of	# to
1	Chironon			of larvae	Organisms	Ref.Co
5	Similida		LUT HIT HH	· · · · · · · · · · · · · · · · · · ·	15	
, <u> </u>					닉	
	- Lipviida	<u>.                                    </u>			1 .	. "
	- Lerydalida	<u>.                                    </u>				
	Hydropso	yeardne Ceratopeu	he WIII		7	·
	li li	Cheumat go			5	·
·	Elmida		34.0			
	Capulda	Allocapora			<u> </u>	· ·
	1	1 - 12	the that their the	- man man I	<u> 31</u>	
)	Rhyacophi	, , ,	LHI		6	
 I	Terneopte	rygidae Strophopter	JK HTWTIMTIMT	PALTHE III	33	,
	Nemour	doe Amphinemore	- Ur		5	
<u> </u>	Philopotam	idae Wormaldia	_ h:		1	· · · · · · · · ·
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	4	TOTALS	<del> </del>		11	

#### Sub-sample and Sample Reduction

(per SOP)

Sub-sample	and	Sample	Reduction	Sheet
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Organisms found in first grid = 41 (Grid # 24)

A minimum of 4 grids must be picked.

Magnifying visors are to be used when sub-sampling.

Grid # of I,D, # Organisms	Grid # of I.D. # Organisms	Grid # of I.D. # Organisms	Grid # of I.D. # Organisms
26 65 10 42			
13 10			
	-		
Total organisms =	58 Total grid	s =	
		•	
			, (
	are >121 organisms, the c) to reduce sample to 12		
	retained = \frac{111}{110} ace sample to 121 organistained for sample (to total		· •
(# of grids from original sample {A})	(% of grids	(final corrected # of gr from original sample)	

# PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME EQU	er FK	LOCATION	
	VERMILE	STREAM CLASS	
	ONG	RIVER BASIN	
STORET#		AGENCY	
	Y- JM	1	
FORM COMPLETED BY		DATE 11/3/10	REASON FOR SURVEY
	T.	TIME AM	<u> </u>
	A - A.		
WEATHER CONDITIONS	Now	Past 24	Has there been a heavy rain in the last 7 days?
CONDITIONS	□ storm	hours (heavy rain)	O'Yes D'No
1	nin 🗆	(steady rain)  Cl s (intermittent)  Cl	Air Temperature (6 ° C
	%□ <i>/</i> %/	cloud cover 0 %	Other
,			
STTE LOCATION/MAP	Draw a map of the si	te and indicate the areas sam	pled (or attach a photograph)
, ,	$\mathcal{F}_{\mathcal{F}}$	. 1	
·	G	CX GOZ.	Crayfish
		_	σ Λ· Ι
		+ 4	Crayfish
	·		
	PICS		NH 4.7
	1100		P
	75-80		93
	45.00		00
	Iphone		
$\mathcal{L}_{\mathbf{x}} = \sum_{i \in \mathcal{X}_{\mathbf{x}}} \mathcal{L}_{\mathbf{x}}$	201104E		(mad 512
	width 1	4.1	Cora 3
n - e	width !	14	
·			Touch 72
	al vi d	zva da v	13 10m/0 +,T
	= '		1
	•-3		
,			
STREAM	Stream Subsystem		Stream Type
CHARACTERIZATION	□ Percaniel □ Int	ermittent 🖾 Tidal 🔻 .	Stream Type  Cl Coldwater Cl Warmwater
,	Stream Origin	C) Spring-fed	Catchment Areakm²
	Non-glacial montac	C) Spring-fed  C) Mixture of origins  C) Other	

## PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATE	ershed Ures	137	lominant Surrounding I nest C Con cid/Pasture C Inch gricultural C Other sectorial	urtrial	Local Watershed D	ome potential sources
RIPAR VEGE (18 me	HAN TATION ter buffer)	J. A.	cate the dominant type ces inant species present	spirecord the Shrubs	dominant species present	
INSTR	EAM URES	Estin Samp Area Estin Surfi	nated Stream Depth	55 <u>m</u> km²	High Water Mark Proportion of Reach Morphology Types C Raffic 60 %	Denveranted by Char
LARGE WOODY LWD m² Density of LWD				_m²/km² (L.WI	)/ reach area)	E TNO
	AQUATIC VEGETATION  Indicate the dominant type and Rooted emergent  Floating Algae  dominant species present  Portion of the reach with aqua			Attached Algae	gent C Rooted floating	C) Free floating
WATER	( QUALITY	Special Dissolution Dissolutio	cruture° C lc Conductance ved Oxygen		Water Surface Oils O Slick O Sheen O None O Other	Chemical Cother  Globs D Flecks
SEDIME SUBSTR		Oders O Non O Cher	nal C Sewage		Turbidity (if not mease of Clear Slightly by Stained  Deposits Sindge Sawdust TRailet shells	ared Turbid Other
<u> </u>	·	00/	nt □ Slight □ Moder	ste □ Profi	Looking at stopes which are the undersides blue	ch are not desply embedded, ck in color?
	(300000 80	TRATE	COMPONENTS 100%)		ORGANIC SUBSTRATE (	COMPONENTS
Substrate Type	Diamete	r .	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Boulder Cabble	oulder > 256 mm (10")		<u>5</u>	Detritus	sticks, wood, course plant materials (CPOM)	25
Cobble Gravel	64-256 mm (2.5° 2-64 mm (0.1°-2	5")	60 20	Muck-Mud	black, very fine organic (FPOM)	
Sand Silt	0.06-2mm (gritty 0.004-0.06 mm	) 	10	Mari	groy, shell fragments	
Clay	< 0.004 mm (slic)	()		<u> </u>	<u> </u>	

## HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION# GF L RIVERMILE	STREAM CLASS	
LATLONG	RIVER BASIN	
STORET#	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE 11 5 / Z TIME AM FM	REASON FOR SURVEY

	Habitat		Conditio	n Category	
1	Parameter	Optimal	Suboptimal	Marginal	Poor
	1. Epifanual Substrate/ Available Cover	Greater than 70% of substrate favorable for epifeumal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	adequate babitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at	20-40% mix of stable	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
1	SCORE	nor danascar).	high end of scale).		
Parameters to be evaluated in sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity	Grevel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by time sediment.
	SCORE	of niche space.			
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shellow, fast-deep, fast-shellow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
Para	SCORE		nggaran (1964) ay ay ay ay ay ay ay ay ay ay ay ay ay		
	4. Sediment Deposition	and less than 5% of the bottom affected by sediment deposition.		Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, mereased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE		1		
	5. Channel Flow Status	both lower banks, and minimal amount of	available channel; or <25% of channel	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE				

### HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

	Habitat		Condition	on Category	
	<u>Parameter</u>	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Charmelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabies or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or ramoved entirely.
	SCORE				
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor babitat; distance botween riffles divided by the width of the stream is a ratio of >25.
,	SCORE				
	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Bunks stable; evidence of crossion or bank failure absent or minimal; little potential for finne problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly bealed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of crosion; high crosion potential during floods.	Unstable; many croded areas; "raw" areas frequent along straight sections and bends; obvious bank sleughing; 60-100% of bank has erosional scars.
	SCORE (LB) SCORE (RB)				Crosional scars.
	9. Vegetative Protection (score each bank)		70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; discription evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	half of the potential plant	Less than 50% of the streambank strifaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 continueters or less in average stubble height.
)	SCORE(LB) SCORE(RB)			The second secon	
V b	0. Riparian /egetative Zone Vidth (score cach ank riparian zone)	>18 meters; human activities (i.e., parking	Width of riperisn zone 12-18 meters; human activities have impacted zone only minimally.	12 meters; human activities have impacted	Width of riparian zone <6 meters: little or no riparian vegetation due to numan activities.
S	CORE(LE)		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		

Total Score \_\_\_\_

ROB Road